UNITED STA[illegible]S DEPARTMENT OF COMMERCE
Pat nt and Trademark Offic
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/556,795	04/25/00	HATA	S 106096

MMC1/0710

OLIFF & BERRIDGE PLC
P O BOX 19928
ALEXANDRIA VA 22320

EXAMINER	
SARKAR, A	
ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 07/10/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trad marks

Offic Action Summary	Application No. 09/556,795	Applicant(s) HATA ET AL.	
	Examiner Asok K. Sarkar	Art Unit 2813	

-- The MAILING DATE of this communication appears on the c ver sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on 25 April 2000 .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-22 is/are pending in the application.

4a) Of the above claim(s) 1 and 2 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 3-22 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☒ Notice of References Cited (PTO-892)

16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .

18) ☐ Interview Summary (PTO-413) Paper No(s). _____ .

19) ☐ Notice of Informal Patent Application (PTO-152)

20) ☐ Other: .

DETAILED ACTION

Response to Arguments

1. Applicant's arguments with respect to claims 3 - 22 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 3 – 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engelke et al., US 5,827,343.

Regarding claim 3, Engelke discloses a method for producing a thin film-structure by the following steps:

- forming on a substrate of semiconductor or metal substrate 2, a thin film of an amorphous material (glass) in column 3, lines 33 – 47 (see Fig. 1);
- heating the thin film of glass to a temperature below the melting point T_g to deform the thin film to a given shape (see Figs 2a – 2c) in column 3, lines 47 – 55, and
- cooling the glass to room temperature from the deformation temperature to stop deformation and form the thin film structure in column 4, line 43.

Engelke discloses heating the glass between the room temperature and the transformation temperature.

But, Engelke fails to disclose heating to a temperature within the supercooled liquid phase region to deform the glass and cooling the glass to room temperature to retain the deformed structure.

However, given the substantial teaching of Engelke, it would have been obvious to one with ordinary skill in the art at the time of the invention to heat the glass film to a temperature within the supercooled region to deform the glass and cooling the glass to room temperature to retain the deformed structure. The supercooled liquid phase region of a glass lies near the softening temperature.

Regarding claim 4, Engelke discloses a thin film-structure as explained above regarding claim 3.

Engelke fails to disclose the amorphous material having a glass transition temperature within 200 - 600°C and a temperature width of not less than 20°C in the supercooled liquid phase region.

Examiner takes Official Notice that many glassy materials are known to possess a glass transition temperature within 200 - 600°C and a temperature width of not less than 20°C in the supercooled liquid phase region.

Therefore, it would have been obvious at the time the invention was made to one of ordinary skill in the art to employ an amorphous material of glass having a glass transition temperature within 200 - 600°C and a temperature width of not less than 20°C in the supercooled liquid phase region since the examiner takes Official Notice that amorphous materials with a glass transition temperature within 200 - 600°C and a

temperature width of not less than 20°C in the supercooled liquid phase region is well known.

Regarding claim 5, deformation of the thin film of glass by its own weight is inherent in the disclosed method.

Claims 6, 7 and 9 – 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engelke et al., US 5,827,343 in view of Aksyuk et al., US 5,994,159.

Regarding claim 6, Engelke fails to teach deformation of thin film in the thin film structure by mechanical external force.

Aksyuk teaches a method of fabricating a thin film structure for micro-mechanical device in which the thin film beam 8 (see Fig. 1) is deformed by external mechanical force in column 6, line 22.

Therefore, given the substantial teaching of Engelke in view of Aksyuk, it would have been obvious to one with ordinary skill in the art at the time of the invention to deform the thin film of Engelke by mechanical external force to form the thin film structure.

Regarding claim 7, Engelke fails to teach deformation of thin film in the thin film structure by electrostatic external force.

Aksyuk teaches a method of fabricating a thin film structure for micro-mechanical device in which the thin film beam 8 (see Fig. 1) is deformed by external electrostatic force in column 5, line 62.

Therefore, given the substantial teaching of Engelke in view of Aksyuk, it would have been obvious to one with ordinary skill in the art at the time of the invention to

deform the thin film of Werner by electrostatic external force to form the thin film structure.

Regarding claim 9, Engelke fails to teach deformation of thin film in the thin film structure by electrostatic external force.

Aksyuk teaches a method of fabricating a thin film structure for micro-mechanical device in which the thin film beam 8 (see Fig. 1) is deformed by external electrostatic force wherein an electrode layer made of conductive material is formed nearby the thin film, an opposite electrode being formed opposing the thin film and the thin film is deformed by the electrostatic external forces generated between the electrode layer and the opposite electrode in between column 5, line 61 and column 6, line 13.

Therefore, given the substantial teaching of Engelke in view of Aksyuk, it would have been obvious to one with ordinary skill in the art at the time of the invention to deform the thin film of Werner by electrostatic external force to form the thin film structure wherein an electrode layer made of conductive material is formed nearby the thin film, an opposite electrode being formed opposing the thin film and the thin film is deformed by the electrostatic external forces generated between the electrode layer and the opposite electrode.

Regarding claim 10, Engelke fails to teach deformation of thin film in the thin film structure by magnetic external force.

Aksyuk teaches a method of fabricating a thin film structure for micro-mechanical device in which the thin film beam 8 (see Fig. 1) is deformed by external magnetic force in column 6, line 15.

Therefore, given the substantial teaching of Engelke in view of Aksyuk, it would have been obvious to one with ordinary skill in the art at the time of the invention to deform the thin film of Werner by magnetic external force to form the thin film structure.

Regarding claim 11, Engelke fails to teach deformation of thin film in the thin film structure by magnetic external force.

Aksyuk teaches a method of fabricating a thin film structure for micro-mechanical device in which the thin film beam 8 (see Fig. 1) is deformed by external electrostatic force wherein a magnetic layer made of a magnetic material is formed nearby the thin film, an opposite magnet being formed opposing the thin film and the thin film is deformed by the magnetic external forces generated between the magnetic layer and the opposite magnet in column 6, lines 14 - 20.

Therefore, given the substantial teaching of Engelke in view of Aksyuk, it would have been obvious to one with ordinary skill in the art at the time of the invention to deform the thin film of Engelke by applying magnetic external force to form the thin film structure wherein a magnetic layer made of a magnetic material is formed nearby the thin film, an opposite electrodet being formed opposing the thin film and the thin film is deformed by the magnetic external forces generated between the magnetic layer and the opposite magnet.

Regarding claims 12 – 14, Engelke teaches deforming the thin film amorphous material by heating as described earlier with respect to claims 3 and 5.

Engelke fails to teach deforming the thin film by magnetic forces where the thin film is heated in the Curie Temperature range of the magnetic material such as Ni, Fe, Co and Mn, the Curie Temperature being in the range of 210 – 1200°C.

Aksyuk teaches deforming the thin film by magnetic forces generated by induced current but fails to expressly teach that the magnetic force can be generated by using magnetic materials such as Ni, Fe, Co and Mn having the Curie Temperature in the range of 210 – 1200°C.

However, given the substantial teaching of in view of Aksyuk, it would have been obvious to one with ordinary skill in the art at the time of the invention to deform the thin film of Engelke by heating it within supercooled liquid region and applying magnetic external force to form the thin film structure wherein a magnetic layer is made of a common magnetic materials such as Ni, Fe, Co and Mn having the Curie Temperature in the range of 210 – 1200°C in stead of an electromagnet.

Regarding claims 15 – 18, Engelke teaches deforming the thin film amorphous material by heating as described earlier with respect to claims 3 and 5.

Regarding claim 15, Engelke fails to teach to form a subsidiary layer made of a material having a different thermal expansion coefficient from that of the amorphous material nearby the film and the thin film is deformed by the stress resulting from the difference in thermal expansion coefficient between the thin film and the subsidiary layer generated in their interface. Engelke also fails to teach the magnitude of the thermal expansion coefficient, the thickness of the subsidiary layer and the make up of the subsidiary layer.

Aksyuk teaches a method of producing a thin film-structure where the beam is made up of two layers with one layer being polysilicon of a thickness of 1.5 micron and each layer having different linear thermal expansion and the deformation of the thin film is actuated by generating stress due to differential contraction of the two layers which is the result of different linear thermal expansion.

Therefore, given the substantial teaching of Engelke in view of Aksyuk, it would have been obvious to one with ordinary skill in the art at the time of the invention to deform the thin film modifying Engelke's method by using a subsidiary layer made of material having different linear thermal expansion than that of the amorphous thin film material and by simultaneous application of heat.

Regarding claims 16 – 18, Aksyuk teaches the thickness of the subsidiary layer in column 5, line 11 but fails to teach the magnitude of the thermal expansion coefficient, and the make up of the subsidiary layer except that it is polysilicon in column 5, line 10.

However, given the substantial teaching of Engelke in view of Aksyuk et al., it would have been obvious to one with ordinary skill in the art at the time of the invention to judiciously adjust and control parameters of the subsidiary layer such as thermal expansion coefficient, which also depends on the composition and the relative thickness of this layer with respect to the thin film during the deformation of an amorphous glassy thin film structure by the generation of stress due to thermal expansion mismatch through routine experimentation and optimization to achieve optimum benefits (see MPEP 2144.05) and it would not yield any unexpected results. Since the deformation is

also induced by heat, it would be logical to combine the substrate material with the thin film material to provide an efficient deformation mechanism by the thermal expansion mismatch technique.

Regarding claims 19 – 22, Engelke teaches deforming the thin film amorphous material by heating as described earlier with respect to claims 3 and 5.

Regarding claim 19, Engelke fails to teach to form a subsidiary layer including an internal stress is formed nearby the film and the thin film is deformed by the stress resulting from the difference in internal stress between the thin film and the subsidiary layer generated in their interface. Engelke also fails to teach the magnitude of the compressive or tensile stress, the thickness of the subsidiary layer and the make up of the subsidiary layer.

Aksyuk teaches a method of producing a thin film-structure where the beam is made up of two layers with one layer being polysilicon of a thickness of 1.5 micron and each layer having high intrinsic strain and the deformation of the thin film is actuated due to internal stresses of the two in column 5, lines 19 - 33.

Regarding claims 20 – 22, Aksyuk fails to expressly disclose the magnitude of the stress in the subsidiary layer, the relative thickness with respect to the thin film and the composition of the subsidiary layer made by mixing the substrate and the amorphous thin film.

However, given the substantial teaching of Engelke in view of Aksyuk, it would have been obvious to one with ordinary skill in the art at the time of the invention to judiciously adjust and control parameters of the subsidiary layer such as the magnitude

of the internal intrinsic stress which also depends on the composition and the relative thickness with respect to the thin film during the deformation of an amorphous glassy thin film structure by the generation of stress due to the difference in internal stress between them through routine experimentation and optimization to achieve optimum benefits (see MPEP 2144.05) and it would not yield any unexpected results. Since the deformation is also induced by heat, it would be logical to combine the substrate material with the thin film material to provide an efficient deformation mechanism by the internal stress differences between the two materials.

4. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Engelke et al., US 5,827,343 in view of Aksyuk et al., US 5,994,159 as applied to claim 7 above, and further in view of Tregilgas et al., EP 0,762,176 A2.

Engelke fails to teach deformation of thin film in the thin film structure by electrostatic external force.

Aksyuk teaches a method of fabricating a thin film structure for micro-mechanical device in which the thin film beam 8 (see Fig. 1) is deformed by external electrostatic force wherein an electrode layer made of conductive material is formed nearby the thin film, an opposite electrode being formed opposing the thin film and the thin film is deformed by the electrostatic external forces generated between the electrode layer and the opposite electrode in between column 5, line 61 and column 6, line 13.

Aksyuk et al. fails to teach that the thin film is made of a conductive material.

Tregilgas et al. teaches a method of producing a thin film structure where they teach forming a beam 24 (see Fig. 3f) of an amorphous conductive material (nitrided aluminum or non-aluminum alloy) in column 1, lines 49 – 53.

Therefore, given the substantial teaching of Engelke in view of Aksyuk and further in view of Tregilgas, it would have been obvious to one with ordinary skill in the art at the time of the invention to deform the thin film of Werner by electrostatic external force to form the thin film structure wherein the thin film is made of conductive material and the thin film is deformed by the external electrostatic force generated between the thin film and the opposite electrode to form the thin film structure.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 3 – 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saotome et al., "Suparplastic Micro-forming of Microstructures", Proceedings, IEEE Workshop on Micro Electro Mechanical Systems, p 343 – 348,1994.

Regarding claim 3, Saotome discloses a method for producing a thin film-structure by the following steps:

a) forming on a semiconductor die substrate a layer of an amorphous La-Al-Ni alloy material in columns 1 and 2 (see Fig.11);

b) heating (forging) the layer of glass to a temperature within the supercooled liquid phase region and thereby deforming the layer to a given shape, and

c) cooling the alloy to room temperature from the deformation temperature to stop deformation and form the structure in Fig. 11.

Saotome fails to disclose the layer as a thin film.

However, given the substantial teaching of Saotome, it would have been obvious to one with ordinary skill in the art at the time of the invention to form a thin film of the alloy material in stead of the layer and heat the alloy film to a temperature within the supercooled region to deform the alloy and cooling the alloy to room temperature to retain the deformed structure instead of applying external pressure by forging operation.

Regarding claim 4, Saotome discloses a thin film-structure where the amorphous alloy has a glass transition temperature within 200 - 600°C in column 1, page 346.

glass transition temperature within 200 - 600°C

Saotome fails to disclose the temperature width of not less than 20°C in the supercooled liquid phase region.

Examiner takes Official Notice that many glassy materials are known to possess a glass transition temperature within 200 - 600°C and a temperature width of not less than 20°C in the supercooled liquid phase region.

Therefore, it would have been obvious at the time the invention was made to one of ordinary skill in the art to employ an amorphous material of glass having a glass transition temperature within 200 - 600°C and a temperature width of not less than 20°C in the supercooled liquid phase region since the examiner takes Official Notice

that amorphous materials with a glass transition temperature within 200 - 600°C and a temperature width of not less than 20°C in the supercooled liquid phase region is well known.

Regarding claim 5, deformation of the thin film of glass by its own weight is inherent in the disclosed method of Saotome.

7. Claims 6, 7 and 9 – 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saotome et al., "Suparplastic Micro-forming of Microstructures", Proceedings, IEEE Workshop on Micro Electro Mechanical Systems, p 343 – 348,1994 in view of Aksyuk et al., US 5,994,159.

8. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Saotome et al., "Suparplastic Micro-forming of Microstructures", Proceedings, IEEE Workshop on Micro Electro Mechanical Systems, p 343 – 348,1994 in view of Aksyuk et al., US 5,994,159 as applied to claim 7 above, and further in view of Tregilgas et al., EP 0,762,176 A2

Claims 6 – 22 are rejected based on the same arguments as provided in the early part of this office action.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Inoue et al., Materials Transactions, JIM, Vol. 30, p 965 – 72 (1989); Saotome et al., Materials Research Symposium (Meeting Date: Dec. 1998) – proceedings, Vol. 554(1999) and Inoue et al., Kinzoku, Vol. 63(3), p 51 – 57(1993) **disclose methods of**

forming thin film microstructur devices utilizing amorphous materials having supercooled liquid phase regions.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is (703) 308-2521. The examiner can normally be reached on 8:00 AM - 5:00PM ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Bowers can be reached on (703) 308-2417. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-4918.

Asok K. Sarkar
July 6, 2001

E-Mail: asok.sarkar@uspto.gov

Charles D. Bowers Jr.
Charles Bowers
Supervisory Patent Examiner
Technology Center 2800